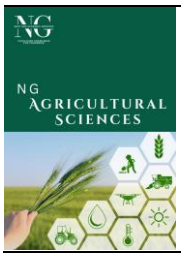

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Attitude and Knowledge of Alternate Wetting and Drying (AWD) Technology Among Paddy Growers in Ranchi, Jharkhand

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HIGHLIGHTS

- Knowledge gaps exist in disease, pest, water, and weed management, with the highest in panipipe installation.
- 76% of paddy growers have a favorable attitude towards AWD, but 24% remain less favorable.
- Education, landholding, income, and progressiveness significantly impact knowledge and attitude towards AWD.

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ABSTRACT

An investigation on paddy growers' knowledge level and attitude towards Alternate Wetting and Drying (AWD) technology was conducted in Jharkhand, India. The research employed an ex-post-facto survey design, collecting data from 144 paddy growers using a structured interview schedule. The findings revealed that while the majority of respondents (67%) had good knowledge of nutrient management, significant knowledge gaps existed in areas such as disease and pest management (23.61% gap), water management (22.69% gap), and weed management (20.83% gap). Regarding AWD technology, respondents demonstrated the highest knowledge gap in the installation of panipipe (28.94%), followed by the implementation of AWD (28.70%) and its benefits (28.70%). The attitude of paddy growers towards AWD was generally positive, with 76% having a favourable attitude. 24% had a less favourable or unfavourable attitude, highlighting the need for continued efforts to change perceptions. The study identified several socio-economic variables, including education, landholding, average annual income, agricultural implement possession, social participation, cosmopoliteness, mass media exposure, extension participation, extension contact, and progressiveness, that significantly influenced both knowledge and attitude towards AWD technology.

1. INTRODUCTION

Rice is a staple food for a significant portion of the global population, and its cultivation plays a crucial role in food security and agricultural economies (Mohidem et al., 2022). Traditional rice cultivation methods often involve continuous flooding, which can be water-intensive and environmentally unsustainable. In recent years, the Alternate Wetting and Drying (AWD) technology has emerged as a promising alternative, offering potential benefits in terms of water conservation, reduced greenhouse gas emissions, and improved agricultural productivity (Gao et al., 2024).

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Rice is the primary food source for over half of the world's population, particularly in Asia, Africa, and Latin America. It is a critical component of food security strategies in many developing countries, where rice production directly impacts the livelihoods of millions of smallholder farmers. The importance of rice in global food security cannot be overstated, as it provides a significant portion of the daily caloric intake for billions of people. Ensuring sustainable rice production is therefore essential for meeting the growing global demand for food while minimizing environmental impacts.

Traditional rice cultivation methods, which typically involve maintaining continuous flooding in paddy fields, have been practised for centuries. While these methods have proven effective in ensuring high yields, they come with significant environmental costs. Continuous flooding requires large amounts of water, often leading to water scarcity issues in regions where water resources are limited (Alotaibi et al., 2023). Flooded paddy fields are a major source of methane emissions, a potent greenhouse gas contributing to climate change. The environmental footprint of traditional rice cultivation has thus become a growing concern in the context of sustainable agriculture and climate change mitigation. AWD technology has gained increasing attention in recent years. AWD involves periodically draining and reflooding paddy fields, allowing for alternating periods of wetting and drying (Mote et al., 2022). This innovative approach has been shown to significantly reduce water usage by up to 30%, making it a more sustainable option in regions facing water scarcity. AWD has been demonstrated to reduce methane emissions from paddy fields by up to 51%, contributing to climate change mitigation efforts (Arai, 2022). Despite these potential benefits, the adoption of AWD technology among paddy growers has been relatively slow in many regions. One of the key factors influencing the adoption of new agricultural technologies is the farmers' knowledge and attitude towards the technology (Giua et al., 2022). Understanding the knowledge level and attitude of paddy growers towards AWD technology is essential for designing effective extension programs and promoting its wider adoption.

The successful adoption of any new agricultural technology largely depends on the farmers' knowledge and attitude towards it. Farmers' knowledge of the technology influences their ability to implement it correctly and benefit from its advantages. Attitude, on the other hand, reflects their willingness to adopt and continue using the technology. Previous studies have shown that farmers with higher levels of knowledge and a positive attitude towards a new technology are more likely to adopt it and integrate it into their farming practices (Pfeiffer et al., 2021). Understanding the knowledge level and attitude of paddy growers towards AWD technology is crucial for identifying the barriers to its adoption and developing targeted interventions to overcome these barriers.

2. MATERIALS AND METHODS

An ex-post-facto research design used as experimental method to study the knowledge level and attitudinal response of paddy growers regarding Alternate Wetting and Drying (AWD) technology. Survey design served the authors well as it enables them to receive quantitative data from large numbers of respondents which permits broader population generalization among paddy growers in their study area. The research area consists of Ranchi district which holds prominent significance for paddy farming. The researchers used stratified random sampling to choose the respondents for the study. The survey area received its divisions according to three categories of land ownership measurements. Researchers randomly selected specific number of paddy growers from each population stratum to obtain adequate representation in all landholding categories. The research selected 144 paddy growers as participants. Structures interviews served as the method for data collection.

A set of questions determined knowledge levels regarding topics such as water management combined with weed management and nutrient management and disease and pest management. The survey about AWD technology contained four sections that addressed panipipe preparation, pipe installation, AWD implementation, and AWD advantages. The participants assessed their awareness of different farming subjects by choosing scores from 0 to 5 representing "not known" at one end and "fully known" at the other end. A Likert scale helped assess the respondents' responses regarding AWD technology. The survey posed multiple statements about AWD technology to the respondents who required to mark their agreement using a five-point scale starting from "strongly disagree" to "strongly agree." The researchers used three categories to classify attitude results into less favourable and favourable and more favourable.

Analysis of gathered data occurred through use of the SPSS software tool. Frequency distribution and mean scores together with gap percentages in descriptive statistics helped summarize the knowledge and attitude levels of the respondents. Researchers calculated gap percentages to determine which factors showed major knowledge deficits among the respondents. To measure the relationship

validity SPSS performed correlation assessment on these variables against knowledge and attitude data points. Socio-economic variables were assessed for their important roles as predictors of knowledge and attitude by implementing Multiple regression analysis.

3. RESULTS

3.1. Knowledge level of the respondents

Table 1 revealed that good knowledge of nutrient management existed among 67 percent of the respondents although other forms of rice crop management knowledge remained lower. All participants had at least partial knowledge of nutrient management or extensive knowledge of this farming practice. No respondents were totally unaware of this subject. Water management in rice was among the aspects the respondents clearly understood after water management itself. The study participants demonstrated adequate knowledge of weed management and disease and pest management through their mean scores of 2.77 and 2.56.

The analysis revealed that disease and pest management had 23.61% knowledge gap, totalling with 22.69% and 20.83% and 11.11% gap in water management and weed management and nutrient management respectively. A good sign showed that nutrient management knew only a low 11.11 percent gap existed. Research participants showed heightened awareness about the proper management of nutrients in the study region. A reduction of knowledge gaps about other crop management aspects will lead to better practices for rice cultivation which boosts both production levels and productivity.

Table 1. Distribution of respondents according to knowledge level (n=144)

Sl. No.	Category	Fully known		Partially known		Not known		Mean Score	Gap %
		f	%	f	%	f	%		
1.	**Crop management of rice**								
1.	Water Management	49	34	92	64	3	2	2.86	22.69
2.	Weed Management	56	39	86	60	2	1	2.77	20.83
3.	Nutrient Management	96	67	48	33	0	0	4.02	11.11
4.	Disease and pest Management	43	30	100	69	1	1	2.56	23.61
2.	**Alternate Wetting and Drying (AWD) technology**								
1.	Preparation of Panipipe	47	33	85	59	12	8	2.79	25.23
2.	Installation of Panipipe	39	27	85	59	20	14	2.73	28.94
3.	Implementation of AWD	59	41	46	32	39	27	2.41	28.70
4.	Benefits of AWD	60	42	44	31	40	28	2.79	28.70

The respondents in the study area were unfamiliar with AWD techniques so researchers attempted different awareness activities and demonstrations as an introduction method. After the season researchers attempted to gauge respondent understanding of AWD operations. This data shows that 42% of respondents possessed full knowledge of AWD benefits but 41% obtained full knowledge of both AWD implementation and panipipe installation and preparation. Respondents displayed better responses about how to prepare panipipe alongside understanding AWD benefits compared to knowledge about AWD execution and panipipe setup.

The highest knowledge gap stood at 28.94% during panipipe installation yet both AWD implementation and benefits of AWD showed 28.7% gap percentages. The results showed that farmers had the least knowledge gap regarding panipipe preparation with 25.23 percent. Farmers paid extra attention to panipipe preparation because it served as the first essential step of AWD implementation. The farmers needed to actively involve themselves with additional aspects of implementation. Further awareness activities together with demonstrations should help decrease the general level of understanding.

3.2. Attitude of respondents on AWD

An attitude represents the fundamental direction of mental and behavioral tendencies towards specific things. Behavioral predisposition toward attitude referents develops through an everlasting system of beliefs. The evaluation of an attitude object establishes the level of positivity or negativity which extends from extreme negative to extreme positive. Research investigated the survey

participants' opinions about AWD technology within the chosen study region. The research group split into three segments according to mean score calculation and standard deviation evaluation. A majority of respondents (58 percent at 83 numbers) expressed favorable views about AWD technology while less favorable views came from 24 percent (35 numbers) of respondents and favorable responses from 18 percent (26 numbers) of the participants. AWD technology receives favorable views from 76% of the participants but 24% of respondents have either unfavorable or less favorable opinions about it. AWD exists as a standard natural occurrence because this technology is relatively new for the region.

Table 2. Distribution of respondents according to their attitude towards Alternate Wetting and Drying (AWD) (n=144)

Category	Score Range	Frequency	Percentage (%)	Mean	Std. Deviation
Less favourable	≤ 38.15	35	24		
Favourable	38.16 – 56.17	83	58	47.16	9.01
More favourable	≥ 56.18	26	18		

Note: Less favourable: ≤ (Mean − 1 SD); Favourable: (Mean ± 1 SD); More favourable: ≥ (Mean + 1 SD)

Table 3. Correlation Between Socio-Economic Variables and the Knowledge Level and Attitude of Respondents (n=144)

		Knowledge Level		Attitude	
Sl. No.	Variables	r-value	Remarks	r-value	Remarks
1	Age	-0.313	**	-0.288	**
2	Education	0.51	**	0.431	**
3	Caste	-0.219	**	-0.182	*
4	Family Type	-0.025	NS	-0.008	NS
5	Family Size	-0.009	NS	-0.097	NS
6	Land Holding	0.37	**	0.331	**
7	Average Annual Income	0.533	**	0.469	**
8	Agricultural Implement Possession	0.416	**	0.432	**
9	Social Participation	0.651	**	0.609	**
10	Cosmopoliteness	0.629	**	0.568	**
11	Mass Media Exposure	0.685	**	0.646	**
12	Extension Participation	0.666	**	0.667	**
13	Extension Contact	0.552	**	0.562	**
14	Progressiveness	0.769	**	0.732	**
15	Scientific Orientation	-0.139	NS	-0.093	NS

Note: * Significant at 0.05 level (2-tailed); ** Significant at 0.01 level (2-tailed); NS: Non-significant.

3.3. Relationship between socio-economic variables with knowledge level and attitude

An analysis of the table 3 showed that family background characteristics together with family dimensions and scientific orientation failed to demonstrate any meaningful links to respondent knowledge or these factors did not affect knowledge acquisition. The research outcomes demonstrated that age and caste variables showed negative linkage with knowledge levels of respondents based on their r-values which reached .313 and .219. The table 3 data showed that the most impactful variable among all for

knowledge level changes was progressiveness with a score of .769 while mass media exposure scored .685 followed by extension participation with .666 and social participation at .651 and cosmopoliteness at .629 and extension contact at .552 as well as average annual income at .533 and education at .510 and agricultural implement possession at .416 and land holding at .370. Jha (2012) confirmed the study results as did Singh et al. (2014). Research results demonstrated that family type and family size did not influence knowledge changes of respondents while scientific orientation and every other variable together produced significant effects on respondents' knowledge development. Jha (2012) supported the obtained result. The analysis demonstrated that both age and caste showed negative relationships with knowledge acquisition among respondents. Research results indicated that knowledge level decreases as the participants grow older. Lack of higher education leads older adults toward decreased exposure to various sources of information because they hold less cosmopolitan awareness. The elderly generation held no superior understanding compared to younger respondents. The young individuals had better access to various innovations while also possessing higher educational levels than the elderly group. The conversion of caste from General to ST resulted in a decrease of knowledge level. Educational attainment for scheduled caste and scheduled tribe groups remained lower than what general as well as other backward class people achieved in education. Other backward class members along with general caste maintained higher knowledge levels than members of scheduled caste and scheduled tribe.

Table 4. Multiple Linear Regression Analysis of Socio-Economic Variables with Knowledge Level and Attitude of Respondents (n=144)

Model	Knowledge Level					Attitude				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta			B	Std. Error	Beta		
(Constant)	-0.711	5.098		-0.139	0.889	31.542	4.839		6.518	0
Age	-0.016	1.216	0	-0.013	0.99	-1.963	1.155	-0.14	-1.7	0.092
Education	1.013	0.586	0.125	1.729	0.086	-0.25	0.556	-0.036	-0.449	0.654
Caste	0.029	0.797	0.002	0.037	0.971	0.709	0.757	0.057	0.936	0.351
Family type	-1.134	1.354	-0.054	-0.838	0.404	1.585	1.285	0.087	1.233	0.22
Family size	0.441	1.077	0.026	0.41	0.683	-2.175	1.022	-0.148	-2.128	0.035
Landholding	0.243	0.879	0.018	0.276	0.783	0.541	0.835	0.047	0.648	0.518
Annual Income	2.077	1.225	0.131	1.696	0.092	0.834	1.163	0.061	0.717	0.475
Agricultural Implement Possession	-0.176	0.726	-0.016	-0.242	0.809	0.946	0.69	0.096	1.371	0.173
Social Participation	0.496	0.3	0.123	1.652	0.101	0.393	0.285	0.113	1.379	0.17
Cosmopoliteness	0.54	0.64	0.067	0.843	0.401	-0.086	0.607	-0.012	-0.142	0.888
Extension Participation	0.51	0.419	0.098	1.218	0.225	0.644	0.398	0.142	1.618	0.108
Extension Contact	0.085	0.304	0.019	0.281	0.779	0.293	0.289	0.076	1.016	0.311
Progressiveness	2.34	0.395	0.465	5.927	0	1.922	0.375	0.443	5.128	0
Scientific Orientation	-0.157	0.098	-0.086	-1.609	0.11	-0.056	0.093	-0.035	-0.602	0.548
	R Square = .702 Adjusted R Square = .670; Std. Error of the Estimate = 5.99727					R Square = .640; Adjusted R Square = .601; Std. Error of the Estimate = 5.69				

The analysis showed that knowledge levels increased in line with the variables of progressiveness and mass media exposure as well as extension participation, social participation, cosmopoliteness, extension contact, average annual income, education, agricultural implement possession and land holding. Progressiveness proved to have the highest significant correlation with knowledge level among all analyzed variables. People with higher progressiveness showed

more interest in innovations which led to their possession of additional information. People who used mass media and participated socially along with extension services and cosmopolitan activities gained better knowledge about various innovations.

The data presented in Table 3 confirmed that education level, landownership amount, average yearly earnings, ownership of agricultural equipment, involvement in social programs, cosmopolitan behavior, mass media usage as well as connections with the extension service and progressiveness showed positive links to AWD attitude among respondents. Age along with caste demonstrated negative connections to respondent attitudes while family structure and the number of family members did not establish statistical relationships. Research results match those presented by Singh et al. (2014). People in younger and middle age ranges showed higher resistance towards new agricultural technology along with innovative ideas. The percentage of resistance decreased as the respondents got older. General caste people possess higher levels of education as well as exposure to new technology in comparison to OBC, SC and ST people. The outlook of individuals within social systems emerges directly from their levels of education and social participation combined with cosmopoliteness along with their experience in mass media exposure and both extension participation and extension contact. The mentioned variables proved to have a significant positive influence on human attitudes. The socioeconomic standing of people becomes clear through their control over land and their yearly income levels which subsequently influences their readiness to adopt modern techniques. This demographic group had both high risk tolerance as well as extensive use of improved farming practices.

The study performed regression analysis to demonstrate the cause-and-effect relationship between socio-economic factors selected for study and the respondents' knowledge level results. Table 4 shows that the respondents' knowledge levels had significant negative relationship with progressiveness. The R Square value points toward an 70.2 percent contribution of these socio-economic variables to improve respondent knowledge levels. Regression analysis evaluated the direct social cause and effect relationship between the selected socio-economic variables on the resulting respondent attitudes toward AWD technology. A study established that progressiveness together with family size strongly influenced the attitudes of the respondents. The R Square value of 0.640 indicates this combined impact of socio-economic variables increases knowledge level of the respondent by 64 percent.

4. DISCUSSION

The study assessed the knowledge level and attitude of paddy growers towards Alternate Wetting and Drying (AWD) technology in Jharkhand, revealing several key insights. The findings indicated that the majority of respondents had a good knowledge of nutrient management, with 67% of the respondents demonstrating a high level of understanding in this area. This suggests that farmers in the study area were well aware of the importance of proper nutrient management for crop health and productivity. The relatively low knowledge gap (11.11%) in nutrient management further supports the notion that farmers were conscious of the need for balanced and timely application of nutrients (Chivenge et al., 2022). Knowledge gaps in other areas of crop management were more pronounced. The knowledge gap in disease and pest management was 23.61%, followed by water management (22.69%) and weed management (20.83%). These findings highlight the need for targeted extension programs that focus on improving farmers' knowledge in these critical areas. Effective management of diseases, pests, and weeds is essential for maintaining high yields and ensuring the overall health of the rice crop. Proper water management is crucial for optimizing water use efficiency and reducing the environmental footprint of rice cultivation (Champness et al., 2023). Regarding AWD technology, the study found that while a significant proportion of respondents had good knowledge of the benefits of AWD (42%) and the preparation of panipipe (33%), there were notable knowledge gaps in other aspects. The highest knowledge gap was observed in the installation of panipipe (28.94%), followed by the implementation of AWD (28.70%) and the benefits of AWD (28.70%) (Mahadi et al., 2018). This suggests that while farmers were aware of the potential benefits of AWD, they may lack the practical knowledge and skills required to effectively implement the technology. Further awareness and demonstration activities were needed to bridge these knowledge gaps and facilitate the wider adoption of AWD technology.

The study also assessed the attitude of paddy growers towards AWD technology, revealing that a majority (76%) had a favourable attitude towards the technology. This positive attitude is encouraging, as it indicates that farmers were open to adopting AWD and recognized its potential benefits. However, a significant proportion (24%) still had a less favourable or unfavourable attitude, highlighting the need for continued efforts to change perceptions and promote the benefits of AWD (Mitchell et al., 2020).

The correlation analysis revealed that several socio-economic variables significantly influenced the attitude of respondents towards AWD. Education, landholding, average annual income, agricultural implement possession, social participation, cosmopoliteness, mass media exposure, extension participation, extension contact, and progressiveness all had positive and significant relationships with attitude (Panda et al., 2019). This suggests that farmers who were more educated, had larger landholdings, higher incomes, and greater access to resources and information were more likely to have a positive attitude towards AWD technology. These findings underscore the importance of targeted extension programs that focus on educating and informing farmers about the benefits of AWD, particularly those who may lack access to resources and information.

The multiple regression analysis identified progressiveness as the most significant predictor of both knowledge and attitude towards AWD technology. This finding highlights the importance of fostering a progressive mindset among farmers, encouraging them to adopt innovative practices and technologies. Other significant predictors of knowledge included mass media exposure, extension participation, social participation, cosmopoliteness, extension contact, average annual income, education, agricultural implement possession, and landholding. These variables collectively explained 70.2% of the variation in knowledge levels among respondents, indicating their substantial influence on farmers' knowledge acquisition (Sharma et al., 2020). Progressiveness and family size were identified as significant predictors of attitude towards AWD technology, accounting for 64% of the variation in attitude. This suggests that family dynamics and the overall progressive outlook of the household play a crucial role in shaping farmers' attitudes towards new technologies. These findings emphasize the need for comprehensive extension programs that not only provide technical knowledge but also address socio-economic factors that influence farmers' willingness to adopt new practices.

5. CONCLUSIONS

The findings revealed that while the majority of respondents had a favourable attitude towards AWD technology, significant knowledge gaps existed in critical areas of crop management and AWD implementation. The study found that respondents demonstrated a high level of understanding of nutrient management, with 67% of the respondents showing good knowledge in this area. Knowledge gaps were more pronounced in other areas such as disease and pest management, water management, and weed management. Regarding AWD technology, respondents had the highest knowledge gap in the installation of panipipe, followed by the implementation of AWD and its benefits. The attitude of paddy growers towards AWD technology was generally positive, with 76% of respondents having a favourable attitude. 24% of respondents had a less favourable or unfavourable attitude, indicating the need for continued efforts to change perceptions and promote the benefits of AWD. The correlation and regression analyses revealed that several socio-economic variables, including education, landholding, average annual income, agricultural implement possession, social participation, cosmopoliteness, mass media exposure, extension participation, extension contact, and progressiveness, significantly influenced both knowledge and attitude towards AWD technology. The study concludes that while there is a positive inclination towards AWD technology among paddy growers, there is a need for comprehensive extension programs to bridge the knowledge gaps and address socio-economic factors that influence farmers' attitudes. Future research should focus on developing and implementing targeted extension programs that provide practical training and information on AWD technology, as well as addressing the socio-economic factors that influence farmers' willingness to adopt new practices. It can facilitate the wider adoption of AWD technology, contributing to more sustainable and productive rice farming systems in the region.

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